

Appl. No. 10/688,412  
Response dated August 18, 2005  
Reply to office action of August 1, 2005

### Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

#### Listing of Claims:

1. (Currently amended) A method for forming a catalyst, comprising:
  - (a) contacting a support material with a catalytic metal-containing compound to form a catalyst precursor, wherein the support material comprises boehmite having an average crystallite size of from about 4 nm to about 30 nm; and
  - (b) treating the catalyst precursor to obtain a catalytic metal oxide from the catalytic metal-containing compound and to obtain a catalyst support from the boehmite.
2. (Original) The method of claim 1 wherein the average crystallite size is in a range of from about 6 nm to about 30 nm.
3. (Original) The method of claim 1 wherein the average crystallite size is in a range of from about 8 nm to about 25 nm.
4. (Original) The method of claim 1 wherein the average crystallite size is in a range of from about 10 nm to about 20 nm.
5. (Currently amended) The method of claim 1 wherein the boehmite comprises a mixture of a first boehmite material having a first average crystallite size and a second boehmite material having a second average crystallite size, wherein the first and second average crystallite sizes differ by at least 1 nm.
6. (Original) The method of claim 5 wherein the first average crystallite size is at least about 1 nm smaller than the second average crystallite size.

Appl. No. 10/688,412  
Response dated August 18, 2005  
Reply to office action of August 1, 2005

7. (Original) The method of claim 5 wherein the first average crystallite size is at least about 3 nm smaller than the second average crystallite size.
8. (Original) The method of claim 5 wherein the first average crystallite size is at least about 5 nm smaller than the second average crystallite size.
9. (Original) The method of claim 5 wherein the first average crystallite size is in a range of from about 4 nm to about 15 nm, and wherein the second average crystallite size is in a range of from about 10 nm to about 30 nm.
10. (Original) The method of claim 9 wherein a weight ratio of the first boehmite material to the second boehmite material is in a range of from about 1:99 to about 99:1.
11. (Original) The method of claim 10 wherein the weight ratio the first boehmite material to the second boehmite material is in a range of from about 1:3 to about 3:1.
12. (Original) The method of claim 10 wherein the weight ratio of the first boehmite material to the second boehmite material is about 1:1.
13. (Original) The method of claim 5 wherein the first boehmite has an average crystallite size between about 4 and about 10 nm; and the second boehmite has an average crystallite size between 8 nm and 30 nm.
14. (Original) The method of claim 13 wherein a weight ratio of the first boehmite material to the second boehmite material is in a range of from about 1:99 to about 1:4.
15. (Original) The method of claim 13 wherein a weight ratio of the first boehmite material to the second boehmite material is in a range of from about 1:99 to about 5:95.

Appl. No. 10/688,412  
Response dated August 18, 2005  
Reply to office action of August 1, 2005

16. (Original) The method of claim 5 wherein the first boehmite has an average crystallite size between about 8 and about 20 nm; and the second boehmite has an average crystallite size between 20 nm and 30 nm.
17. (Original) The method of claim 16 wherein a weight ratio of the first boehmite material to the second boehmite material is in a range of from about 4:1 to about 99:1.
18. (Original) The method of claim 16 wherein a weight ratio of the first boehmite material to the second boehmite material is in a range of from about 99:1 to about 95:5.
19. (Original) The method of claim 1 wherein the catalyst support comprises a stabilized aluminum oxide structure.
20. (Original) The method of claim 19 wherein the stabilized aluminum oxide structure comprises gamma-alumina.
21. (Original) The method of claim 1, further comprising pretreating the support material before said contacting the support material with the catalytic metal-containing compound.
22. (Original) The method of claim 21 wherein the pretreating comprises spray-drying.
23. (Original) The method of claim 21 wherein the pretreating comprises preheating at a temperature of from about 250 °C to about 350 °C.
24. (Original) The method of claim 21 wherein the pretreating comprises spray-drying and preheating at a temperature of from about 300 °C to about 350 °C.
25. (Original) The method of claim 1 wherein said treating the catalyst precursor comprises calcining the catalyst precursor to convert at least a portion of the catalytic metal-containing compound to a metal oxide and at least a portion of the boehmite to a stabilized aluminum oxide structure.

Appl. No. 10/688,412  
Response dated August 18, 2005  
Reply to office action of August 1, 2005

26. (Original) The method of claim 25 wherein the calcining is performed at a temperature of from about 200 °C to about 800 °C.
27. (Original) The method of claim 25 wherein the calcining is performed at a temperature of from about 350 °C to about 800 °C
28. (Original) The method of claim 25 wherein the calcining is performed at a temperature of from about 450 °C to about 800 °C.
29. (Original) The method of claim 25 wherein said treating the catalyst precursor further comprises reducing the metal oxide to form the catalytic metal.
30. (Original) The method of claim 1 wherein the catalytic metal is selected from a group consisting of cobalt, iron, nickel, ruthenium, and combinations thereof.
31. (Original) The method of claim 1, wherein the catalytic metal is cobalt.
32. (Original) A catalyst made by the method of claim 1.
- 33-55. (Cancelled)
56. (New) The catalyst of claim 32 wherein the boehmite comprises a mixture of a first boehmite material having a first average crystallite size and a second boehmite material having a second average crystallite size, wherein the first average crystallite size is at least 1 nm smaller than the second average crystallite size.
57. (New) The catalyst of claim 56 wherein the first average crystallite size is at least 3 nm smaller than the second average crystallite size.
58. (New) The catalyst of claim 56 wherein the first average crystallite size is at least 5 nm smaller than the second average crystallite size.

Appl. No. 10/688,412  
Response dated August 18, 2005  
Reply to office action of August 1, 2005

59. (New) The catalyst of claim 56 wherein the first average crystallite size is in a range of from about 4 nm to about 15 nm.
60. (New) The catalyst of claim 56 wherein the first average crystallite size is in a range of from about 8 nm to about 20 nm.
61. (New) The catalyst of claim 56 wherein the second average crystallite size is in a range of from about 8 nm to about 30 nm.
62. (New) The catalyst of claim 32, wherein the catalytic metal is cobalt.
63. (New) The method of claim 1 wherein the boehmite is dispersible in acid.
64. (New) The method of claim 1 wherein the boehmite is non-dispersible in aqueous solution.
65. (New) A method for forming a catalyst, comprising:
- (a) contacting a support material with a catalytic metal-containing compound to form a catalyst precursor, wherein the support material comprises a mixture of at least two boehmites with various average crystallite sizes, wherein the average crystallite sizes differ by at least 1 nm; and
  - (b) treating the catalyst precursor to decompose the catalytic metal-containing compound to a catalytic metal oxide and to transform either partially or totally the boehmite of the support material to a stabilized aluminum oxide structure.
66. (New) The method of claim 65 wherein the boehmite comprises a mixture of a first boehmite material having a first average crystallite size and a second boehmite material having a second average crystallite size, wherein the first average crystallite size is at least 1 nm smaller than the second average crystallite size.

Appl. No. 10/688,412  
Response dated August 18, 2005  
Reply to office action of August 1, 2005

67. (New) The method of claim 66 wherein the first average crystallite size is at least 3 nm smaller than the second average crystallite size.
68. (New) The method of claim 66 wherein the first average crystallite size is at least 5 nm smaller than the second average crystallite size.
69. (New) The method of claim 66 wherein the first average crystallite size is in a range of from about 4 nm to about 15 nm.
70. (New) The method of claim 66 wherein the first average crystallite size is in a range of from about 8 nm to about 20 nm.
71. (New) The method of claim 66 wherein the second average crystallite size is in a range of from about 8 nm to about 30 nm.
72. (New) The method of claim 66 wherein the second average crystallite size is in a range of from about 20 nm to about 30 nm.
73. (New) The method of claim 65 wherein one of the at least two boehmites has an average crystallite size from about 10 nm to about 20 nm.
74. (New) The method of claim 65 wherein the catalytic metal is selected from a group consisting of cobalt, iron, nickel, ruthenium, and combinations thereof.
75. (New) The method of claim 65, wherein the catalytic metal is cobalt.
76. (New) The method of claim 65, further comprising pretreating the support material before said contacting the support material with the catalytic metal-containing compound, wherein the pretreating comprises spray-drying; preheating at a temperature of from about 250 °C to about 350 °C; or spray-drying and then preheating at a temperature of from about 300 °C to about 350 °C.

**Appl. No. 10/688,412**  
**Response dated August 18, 2005**  
**Reply to office action of August 1, 2005**

77. (New) The method of claim 65 wherein the at least two boehmites are spray-dried boehmites.

78. (New) The method of claim 65 wherein the contacting step (1) comprises a multi-step incipient wetness impregnation of the catalytic metal-containing compound; and wherein the treating step (2) includes a first calcination performed at a temperature from about 450 °C to about 800 °C, and any calcination after the first calcination proceeds at a temperature of not more than about 450 °C.